

C L A I M S

1.           A vacuum pick and place device  
2   characterized by comprising:  
3           a pick and place nozzle which includes a  
4   vacuum cup having an air suction port and sucks in air  
5   from the air suction port to lift a part to said lifting  
6   portion;  
7           a vacuum supply unit which supplies a vacuum  
8   for suction to said pick and place nozzle; and  
9           a pick and place confirming sensor which  
10   outputs an electrical signal indicating presence or  
11   absence of a part lifted to said lifting portion on the  
12   basis of a change in flow rate of air sucked in from the  
13   air suction port.
2.           A vacuum pick and place device  
2   according to claim 1, characterized in that said pick  
3   and place confirming sensor includes  
4           a base arranged in a gas channel,  
5           a heater formed as a thin film on a surface of  
6   said base,  
7           a plurality of temperature sensors formed as  
8   thin films on said surface of said base, and  
9           detection means for measuring a gas flow rate  
10   on the basis of a temperature distribution in the  
11   vicinity of said heater which is measured by said  
12   temperature sensors.

3. A vacuum pick and place device

2 according to claim 1, characterized by further  
3 comprising:

4 a valve which controls suction of air from  
5 said pick and place nozzle using the vacuum, and  
6 an air suction passage which connects said  
7 pick and place nozzle, pick and place confirming sensor,  
8 valve, and vacuum supply unit to each other.

4. A vacuum pick and place device

2 according to claim 3, characterized in that said pick  
3 and place confirming sensor includes

4 a flow sensor which detects a change in flow  
5 rate of air measured in said air suction passage between  
6 said valve and pick and place nozzle, and

7 detection means for outputting an electrical  
8 signal indicating the presence or absence of a part  
9 lifted to said lifting portion on the basis of an output  
10 from said flow sensor.

5. A vacuum pick and place device

2 according to claim 4, characterized in that said flow  
3 sensor detects a change in flow rate of air measured in  
4 a portion of said air suction passage which is in the  
5 vicinity of said pick and place nozzle.

6. A vacuum pick and place device

2 according to claim 1, characterized in that

3 said pick and place nozzle includes a  
4 plurality of pick and place nozzles which suck in air

5 through the air suction ports by sharing the vacuum, so  
6 as to lift different parts, and

7 said pick and place confirming sensor is  
8 provided for each of said pick and place nozzles.

7. A vacuum pick and place device  
2 according to claim 1, characterized in that said pick  
3 and place nozzle includes an air suction port which is  
4 provided to one open end and through which air is sucked  
5 in.

8. A vacuum pick and place device  
2 according to claim 7, characterized in that said pick  
3 and place nozzle further includes an air suction hole in  
4 which a flow speed of air sucked in through the air  
5 suction port by the vacuum becomes a sonic speed.

9. A vacuum pick and place device  
2 according to claim 7, characterized in that said pick  
3 and place nozzle further includes an air suction hole  
4 which has a channel sectional area with such a size that  
5 a flow speed of air sucked in through the air suction  
6 port by the vacuum becomes a sonic speed and in which an  
7 opening area of the air suction port changes in  
8 accordance with a state of a part lifted to said lifting  
9 portion.

10. A vacuum pick and place device  
2 according to claim 1, characterized in that  
3 said pick and place nozzle further includes an  
4 air suction hole which opens to the air suction port and

5 guides air, sucked in through the air suction port, to a  
6 nozzle inner chamber of said pick and place nozzle  
7 connected to and in contact with said vacuum supply unit,  
8 and

9               said vacuum supply unit generates a vacuum  
10 with which a pressure at an upstream end of the air  
11 suction hole is substantially not less than twice a  
12 pressure at a downstream end.

11.           A pick and place confirming sensor  
characterized

2 by comprising:

3               a flow sensor which, when a part is to be  
4 lifted to an air suction port of a pick and place nozzle,  
5 detects a change in flow rate of air sucked in through  
6 the air suction port; and

7               detection means for outputting an electrical  
8 signal indicating presence or absence of a part lifted  
9 to said lifting portion on the basis of an output from  
10 said flow sensor.

12.           A pick and place confirming sensor according  
to

2 claim 11, characterized in that

3               said flow sensor includes

4               a base arranged in a gas channel,

5               a heater formed as a thin film on a surface of  
6 said base, and

7               a temperature sensor formed as a thin film on

8 said surface of said base, and  
9 said detection means measures a gas flow rate  
10 on the basis of a temperature distribution in the  
11 vicinity of said heater which is measured by said  
12 temperature sensor.

13. A pick and place confirming sensor according  
to  
2 claim 11, characterized in that said detection means  
3 outputs an electrical signal indicating presence or  
4 absence of a part lifted to the vacuum cup of said pick  
5 and place nozzle on the basis of a change in flow rate  
6 of air measured in an air suction passage between said  
7 pick and place nozzle and a valve which controls suction  
8 of air from the pick and place nozzle of a vacuum pick  
9 and place device.

14. A pick and place confirming sensor according  
to  
2 claim 13, characterized in that said detection means  
3 outputs an electrical signal indicating presence or  
4 absence of a part lifted to said lifting portion on the  
5 basis of a change in flow rate of air measured in a  
6 portion of said air suction passage which is in the  
7 vicinity of said pick and place nozzle.

15. A pick and place confirming sensor according  
to  
2 claim 11, characterized in that said detection means  
3 outputs an electrical signal indicating presence or

4 absence of a part lifted to the air suction port on the  
5 basis of a change in flow rate of air sucked in through  
6 an air suction hole which includes an air suction port  
7 of a pick and place nozzle of a vacuum pick and place  
8 device as one open end, and  
9 in which a flow speed of air sucked in through  
10 the air suction port becomes a sonic speed.

16. A pick and place confirming sensor according  
to  
2 claim 11, characterized in that said detection means  
3 outputs an electrical signal indicating presence or  
4 absence of a part lifted to the air suction port on the  
5 basis of a change in flow rate of air sucked in through  
6 an air suction hole which includes an air suction port  
7 of an pick and place nozzle of a vacuum pick and place  
8 device as one open end and  
9 has a channel sectional area with such a size  
10 that a flow speed of air sucked in through the air  
11 suction port becomes a sonic speed, and in which an  
12 opening area of the air suction port changes in  
13 accordance with a state of a part lifted to said lifting  
14 portion of said pick and place nozzle.

17. A pick and place confirming sensor according  
to  
2 claim 13, characterized by further comprising a  
3 connector to be connected to said air suction passage.

18. A pick and place confirming sensor according

to

2 claim 11, characterized by further comprising a board  
3 which mounts and holds said flow sensor thereon and  
4 which forms a wall of a channel.

19. A pick and place confirming sensor according  
to

2 claim 12, characterized in that said temperature sensor  
3 includes

4 an upstream temperature sensor arranged on an  
5 upstream side of a gas flowing direction,

6 a downstream temperature sensor arranged on a  
7 downstream side, and

8 an ambient temperature sensor arranged near  
9 the upstream side of said base.

20. A pick and place confirming sensor according  
to

2 claim 12, characterized in that

3 said base has a cavity at a central portion  
4 thereof, and

5 a diaphragm which thermally insulates said  
6 temperature sensor and base from each other is further  
7 provided on the cavity.